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⑩ ⑪ CANADIAN PATENT

⑩ TUBING INJECTOR

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No. OF CLAIMS 6

ABSTRACT OF THE DISCLOSURE

A pair of endless chains run between a pair of side plates with the substantially vertical runs being in spaced and parallel relationship. Tubing engaging blocks are secured to the outer surfaces of each said central link of the chains and engage the/tubing which engages between the vertical runs. Adjustments are provided to vary the width between the major portions of the vertical runs thus frictionally engaging the blocks around the tubing which moves the tubing up or down depending on the direction of movement of the chains. The tubing is injected into a well bore for clean out purposes.

BACKGROUND OF THE INVENTION

This invention relates to new and useful improvements in tubing injectors used on oil wells and the like.

If a well is off production due to a sand bridge or other obstruction, the normal procedure to remove such an obstruction is to use a wire-line bailer or a conventional sand washing rig. Bailing requires many trips with the bailer to remove a sand bridge depending upon the amount of sand present and it is not always successful. With a conventional sand washing rig, pipe can be put into the hole to wash out the obstruction, but the process is slow because such pipe can be put into the hole at about 10 to 15 feet per minute.

SUMMARY OF THE INVENTION

The present invention overcomes these disadvantages \*

by providing a tubing injector adapted to be secured to the upper end of the casing extending from a well bore and to inject a hollow flexible pipe downwardly until the obstruction is reached. Compressed air or water or other fluid is then 5 pumped through the tubing to the obstruction thus washing it out of the well.

By utilizing the tubing injector described, the flexible pipe can be inserted and withdrawn from the well bore at about 100 feet per minute as compared to the conventional 10 to 10 15 feet per minute.

The principal object and essence of the invention is to provide an improved tubing injector for use with hollow flexible tubing for inserting said tubing and withdrawing same into and out of the casing of a well bore.

15 Another object of the invention is to provide a device of the character herewithin described which is particularly suited for use with a source of hydraulic power inasmuch as it is preferable to attach an hydraulic motor to the tubing injector thus making a relatively compact package.

20 Yet another object of the invention is to provide a device of the character herewithin described which provides

means to adjust the tension between the vertical runs of the endless chains used in the tubing injector so that the frictional engagement of the vertical runs with the tubing may be adjusted within limits.

Still another object of the invention is to provide a device of the character herewithin described which is simple in construction, small and light to handle, economical in manufacture and otherwise well suited to the purpose for which it is designed.

With the foregoing objects in view, and such other objects and advantages as will become apparent to those skilled in the art to which this invention relates as this specification proceeds, my invention consists essentially in the arrangement and construction of parts all as hereinafter more particularly described, reference being had to the accompanying drawings  
10 in which:-  
15

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevation of the tubing injector installed on a well bore casing and showing, in fragmentary form, part of the reel carrying the flexible tubing.

20 Figure 2 is a side elevation of the tubing injector per se, enlarged with respect to Figure 1.

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Figure 3 is an end view of Figure 2.

Figure 4 is a view similar to Figure 2, but with one side of the casing removed to show the interior thereof.

Figure 5 is a rear view of Figure 2, showing the drive 5 connection but with the cover removed.

Figure 6 is a fragmentary partially sectioned view along the lines 6-6 of Figure 2, but with the chains removed for clarity.

Figure 7 is a view along the line 7-7 of Figure 6.

10

Figure 8 is an enlarged end view of one of the chain

assemblies.

Figure 9 is a side view of Figure 8.

Figure 10 is an underside view of Figure 8.

Figure 11 is an isometric view of one of the links supporting the tubing engaging blocks.

In the drawings like characters of reference indicate corresponding parts in the different figures.

5    DETAILED DESCRIPTION

Proceeding therefore to describe the invention in detail, reference should first be made to Figure 1 in which 10 illustrates the rear end of supporting structure carrying a reel assembly 11 around which hollow flexible tubing 12 is stored, it being understood that the reel may carry up to 15,000 feet 10 of such tubing in one continuous <sup>length</sup> link so that the majority of obstructions within a well bore casing 13 can be reached.

The casing 13 includes a valve control assembly 14 which is conventional, together with a discharge pipe 15 and a 15 conventional blow out preventer and stripper assembly through which the flexible tubing 12 may be injected by the tubing injector collectively designated 17.

The tubing injector 17 comprises a pair of spaced and parallel side plates 18 maintained in the spaced apart relationship by means of spacers 19 and constituting a casing for the mechanism of the injector.

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An hydraulic motor 19' is secured to one side of the casing and is connected to a source of fluid under pressure by means of hoses 20; conventional valving (not illustrated) being provided to control the fluid to the motor and to control the direction of rotation of the motor.

5 Two sets of sprockets are mounted between the side plates 18, each set including upper sprockets 21 and 21A, lower sprockets 22 and 22A, and drive sprockets 23 and 23A, the location of these sprockets being shown in Figure 4. The sprockets are all mounted 10 on spindles 24, 24A, 25, 25A and 26, 26A respectively as indicated in Figure 2, and bearings 27 are mounted on the side plates to support the spindles for rotation, it being understood that the sprockets are secured to the spindles. The chain is three rows wide but sprockets are used only upon the outermost rows as the 15 centre is used with rollers to apply pressure to the tubing engag-  
ing <sup>blocks</sup> ~~box~~ as will hereinafter be described.

Figure 5 shows details of the drive to the set sprockets. A sprocket 28 is driven by the hydraulic motor and an endless chain 29 extends around this sprocket 28 and around drive sprockets 30 and 30A secured to the ends of the spindles 26 and 26A respectively, and a conventional chain tightener assembly 31 is mounted on the side plates 18 for adjusting the tension of this endless chain 29. A cover normally encloses this chain and associated sprockets, but has been removed in the drawings for 25 clarity.

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Tubing injection is undertaken by a pair of endless chain assemblies 32 and 32A, the chain assembly 32 extending around sprockets 21, 22 and 23, and the chain assembly 32A extending around sprockets 21A, 22A and 23A, all of which is  
5 clearly shown in Figure 4.

Sprockets 21 and 22, together with sprockets 21A and 22A cause the chain assemblies 32 and 32A to form vertical runs 33 and 33A which are spaced and parallel to one another. In this connection, the term "vertical runs" refers to the positioning  
10 of these portions of the chain assemblies when the tube injector is installed upon a well bore casing as shown in Figure 1.

Figures 8 to 11 inclusive show the formation of each of these chain assemblies and chain assembly 32 is illustrated, it being understood that chain assembly 32A is similar to construction.  
15

Each chain assembly includes a pair of conventional roller chains 34, the links 35 of which are mounted on common pins 36. Rollers 37 are mounted on the pins 36 between the spaced apart chains 34 and further links 38 are mounted on the pins  
20 on each side of the rollers 37.

Links 38 are provided with block support brackets 39

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extending outwardly at right angles from the outer sides of  
the links and tubing engaging blocks 40 are secured across  
each pair of brackets 39 as shown in Figure 8. Each block is  
provided with an arcuately curved cut-out portion 41 on the  
5 outer surface 42 thereof, the curvature of this block being  
similar to the curvature of the tubing 12 which is engaged  
between these blocks.

A It will therefore be seen <sup>that</sup> if the distance between  
the major portions of the vertical runs 33 and 33A of the  
10 chain assemblies is decreased, the blocks will grip the tubing  
frictionally and move it in the direction of travel of the  
vertical runs, either upwardly or downwardly with reference  
to the drawings.

Means are provided to vary the distance between the  
15 vertical runs 33 and 33A, said means including two pairs of  
brackets 43, 43A and 44, 44A.

Each pair of brackets is mounted upon the casing,  
one pair on each side of the center line thereof which is in-  
dicated by the tubing 12 extending therethrough.

20 There is a bracket of each pair upon each side plate  
18 of the casing and each bracket is secured to a pin 45 which

extends through the casing from one side plate 18 to the other and is mounted within elongated slots 46 formed within the side plates (see Figure 4).

In between the side plates and surrounding the pin 45, 5 is a tube 47 having flanged ends 48 which bear against the inside of the plates 18 in sliding relationship.

The brackets are provided with right angulated extensions 49 in opposition as clearly shown with a nut and bolt assembly 50 extending through apertures within opposing portions 10 49. From the foregoing it will be appreciated that by adjusting the nut and bolt assembly 50, the brackets of each pair will be moved towards or away from one another within the limits of the elongated slots 46.

An elongated mounting plate 51 (see Figures 6 and 7) 15 is secured around each of the tubes 47 and extends parallel with the vertical runs 33 and 33A of the chains and a pair of spaced apart blocks 52 is pivotally secured adjacent each end of this mounting plate 51 by means of pivot pins 53.

20 The edges 55 of the blocks 52 bear against the aforementioned centrally located rollers 37 of the chain assemblies

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on the inner sides thereof or on the sides opposite to which the tubing engaging blocks 40 are mounted and the location of these blocks engaging the rollers is shown in Figure 4.

It will therefore be seen that if the distance between  
5 the brackets 43 is adjusted by the bolt assemblies 50, the ma-  
jor portion of the vertical runs 33 and 33A may be caused to  
frictionally engage the flexible tubing 12 passing therebetween  
thus causing the tubing to be moved in the same direction as the  
vertical runs 33 and 33A.

10 In operation, the flexible tubing 12 is inserted bet-  
ween the vertical runs 33 and 33A and the hydraulic motor 19 is  
operated to cause the vertical runs to move in the direction of  
arrow 56. By adjusting the distance between the vertical runs  
33 and 33A, the tubing engaging blocks 40 engage the tubing  
15 frictionally and drive it downwardly into the well bore casing  
13 until the obstruction is reached.

Fluid may then be pumped through the flexible tubing  
to wash out the obstruction which may be discharged through the  
discharge pipe 15. By reversing the hydraulic motor 19, the  
20 vertical runs 33 and 33A are caused to move in a direction oppo-  
site to arrow 56 thus withdrawing the tubing 12 from the casing  
and re-winding same upon the reel 11.

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Since various modifications can be made in my invention as hereinabove described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without departing from such spirit and scope, it is  
5 intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

## WHAT I CLAIM AS MY INVENTION IS:-

(1) A tubing injector for moving a length of substantially flexible tubing from a reel into and out of a well bore and operated by a source of hydraulic fluid under pressure; comprising in combination a casing securable to the upper end of a well bore, a pair of endless chains journalled in said casing, each of said chains including a substantially vertical run when installed upon the associated well bore, said vertical runs being in spaced and parallel relationship one with the other, means on the outer sides of said chains for engaging around the associated tubing in gripping relationship for moving said tubing in either direction between said vertical runs, means on said casing for varying the distance between the major portions of said vertical runs and hence the gripping relationship of said means on the outer sides of said chains around said tubing, and means to rotate said chains in either direction with said vertical runs of said chains moving in the same direction as one another, said means to vary the distance between the major portions of said vertical runs including a pair of brackets for each of said vertical runs, adjacent said vertical runs, one bracket of each pair being on one side of said casing, the other bracket of each pair being on the other side of said casing, said one brackets being in opposition one with the other, said other brackets also being in opposition one with the other, adjustable means mounting said pairs of brackets for movement towards and away from one another and a tension adjusting block assembly secured between the brackets of each of said pair of brackets inside said casing and engaging the inner side of said vertical runs of said chains, each of said tension adjusting block assemblies including an elongated mounting plate secured between the brackets of each pair of said brackets, and a pair of

spaced apart blocks pivotally mounted one adjacent each end of said mounting plate and in vertical relation one with the other, said blocks engaging said inner sides of said chains in spaced apart relationship one with the other.

(2) The tubing injector according to Claim 1 in which each of said chains includes a pair of sprocket engaging chains in spaced apart relationship one with the other, common pins extending between adjacent links of each of said sprocket engaging chains, rollers mounted on said pins between said adjacent links, links on each side of said rollers engaging around said pins and tubing engaging blocks supported by said last mentioned links and spanning the outer sides of said rollers and part of said adjacent links of said sprocket engaging chains, said blocks having an arcuately curved cut-out on the outer face of said blocks having a curvature similar to the curvature of the outer surface of the associated tubing around which said blocks engage.

(3) The tubing injector according to Claim 1 in which said casing includes a pair of spaced and parallel side plates, and sets of sprockets journaled for rotation between said side plates, said means to rotate said chains being operatively connected to one sprocket of each of said sets of sprockets.

(4) The tubing injector according to Claim 2 in which said casing includes a pair of spaced and parallel side plates, and sets of sprockets journaled for rotation between said side

plates, said means to rotate said chains being operatively connected to one sprocket of each of said sets of sprockets.

(5) The tubing injector according to Claims 1, 2 or 3 in which said means to rotate said chains includes an hydraulic motor secured to said casing and being operatively connected to said source of hydraulic fluid under pressure for rotating said motor in either direction, said motor also being operatively connected to each of said chains.

(6) The tubing injector according to Claim 4 in which said means to rotate said chains includes an hydraulic motor secured to said casing and being operatively connected to said source of hydraulic fluid under pressure for rotating said motor in either direction, said motor also being operatively connected to each of said chains.



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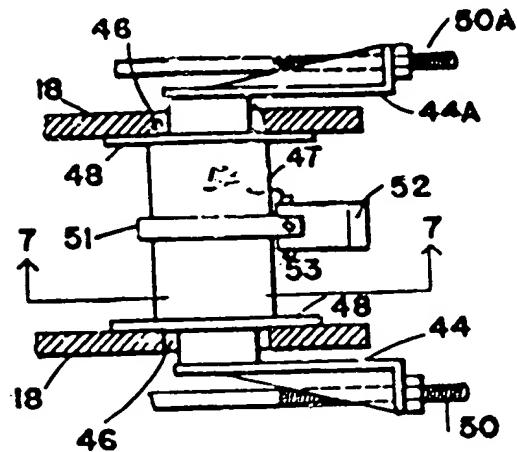


FIG. 6

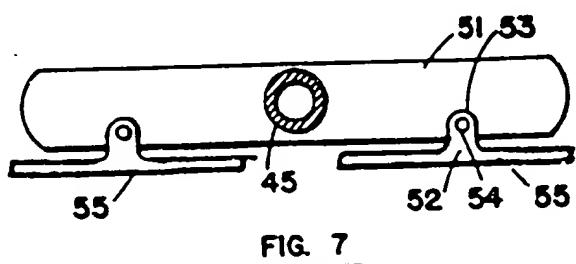


FIG. 7

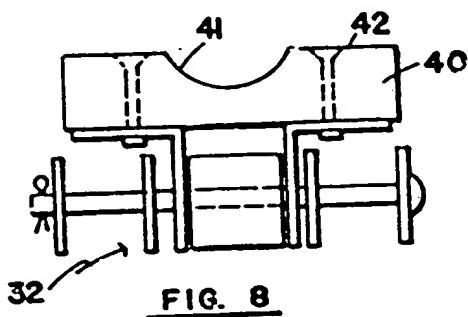


FIG. 8

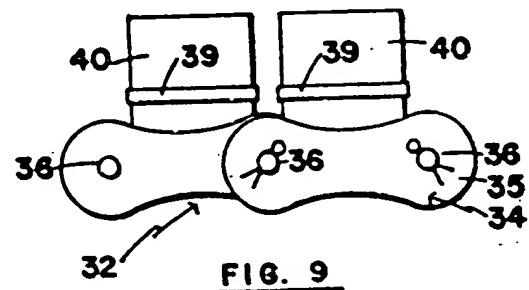


FIG. 9

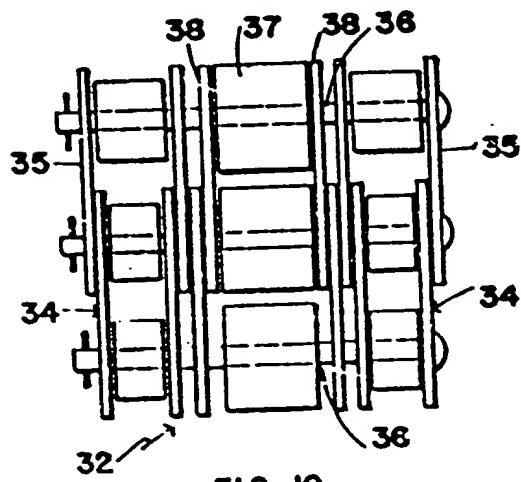


FIG. 10

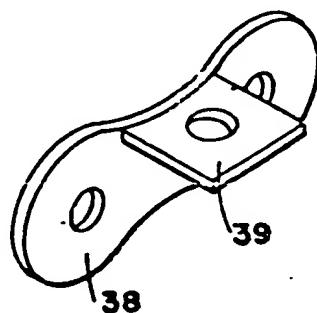


FIG. 11

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